

Original Research Article

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Prevalence of Carriage of Methicillin Resistance *Staphylococcus aureus* among Health Care Workers in a Tertiary Care Center, Kanpur (U.P), India

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ABSTRACT

MRSA is a problem within health care organization and in the community. The aim of this study was to identify the prevalence of *S. aureus* in the anterior nares of health care workers of different occupation including attendants, sweepers, nurses, students, OT technicians and to analyse their antibiogram with reference to methicillin resistance. In this prospective study, total 100 nasal samples were collected from health care workers by using a sterile moistened swab. 20 nasal swabs were taken from each group. MRSA was identified according to CLSI guideline. Out of 100 nasal swabs, 39 yielded *S. aureus* and among these 15 were MRSA. According to their profession, most of the MRSA was isolated from sweepers (71.4%; 5 out of 7) followed by nurses (60%; 2 out of 5), OT technician (37.5%; 3 out of 8), students (33.33%; 2 out of 6) and attendants (15.38%; 2 out of 13). MRSA was mostly isolated from 26-30 age group and male sweepers showed more carriage of MRSA than females. Vancomycin and Linezolid were found to be the most sensitive drugs against *S. aureus*. Pencillin and ampicillin showed 100% resistance and 66.66% and 73.33% resistance was seen for Erythromycin and Cotrimoxazole respectively. The presence of methicillin resistance may cause problems in implementation of hospital infection control programs. This study suggests the need for periodic screening of hospital personnel in order to monitor trends and take steps to treat carriers.

Keywords

Staphylococcus aureus, MRSA, health care workers.

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Introduction

Staphylococcus aureus is a member of the family Micrococcaceae and is the leading cause of Gram positive cocci infections (Lowy, 1998). The primary site of colonization of *S. aureus* in humans is the anterior nares and it seems that most infections are endogenous, ranging from minor skin infection like (boils, carbuncles, impetigo, cellulitis, abscesses), endocarditis, osteomyelitis, foreign-body infections and most fatal necrotizing pneumonia (Lowy, 1998; Van Belkum *et al.*, 2009; Von Eiff *et*

al., 2001). *S. aureus* colonises other body sites including the axillae, perineum, throat, digestive tract and vagina, usually at a lower frequency than the nose (Van Belkum *et al.*, 2009; Wertheim *et al.*, 2005). MRSA colonization leads to infection. MRSA has become a major nosocomial pathogen in community hospitals, long term care facilities and tertiary care hospitals (Lakshmi *et al.*, 2012). Hospital associated Methicillin resistance *S. aureus* (HA-MRSA), and community associated MRSA (CA-MRSA)

distribution is based on epidemiological features and microbiological characteristics (Melter *et al.*, 2003). Hospital worker have higher rates of MRSA nasal colonization than the general population (Godfrey *et al.*, 1958). Asymptomatic colonized patients and health care workers are the major source of MRSA in the hospital environment, the latter being more commonly identified as links in transmission of MRSA between the patients. Approximately 20% of individuals are persistent carriers, about 60% are intermittent carriers and 20% are non carriers (Kluytmans *et al.*, 1997). Carriers play a major role to transmit MRSA from patient to patient via the transiently colonized hands of health care workers, who acquire the organism from patient contact or by handling contaminated material (Hassanain *et al.*, 2013). The growing problem in India is that MRSA prevalence has increased from 12% to 80.83% (Verma *et al.*, 2000). The health care workers who are found to be colonized with *S. aureus* were advised to apply mupirocin ointment in their anterior nares and they should be retested for the nasal carriage of *S. aureus* after 3 months of treatment (Sharon *et al.*, 2013).

This study was undertaken to find out the prevalence of carriage of Methicillin Resistance *Staphylococcus aureus* rate among the health care workers.

Materials and Methods

This was a prospective study conducted in Rama Medical College, Hospital and Research Center, Kanpur, from January 2016-December 2016. A total of 100 nasal swabs were collected from health care workers (doctors, nurses, cleaning staffs, technicians, medical students).

Health care workers of both sexes and all age groups were included. All known cases of

MRSA isolated from the clinical samples were excluded from the study. Demographic information about age, occupation and history of antibiotic in the past 2 weeks was also taken by interviewing the participants at the time of sample collection.

Sample Collection: The specimens were taken from the health care workers (doctors, nurses, cleaning staffs, technicians, medical students) by using a sterile moistened swab inserted into the nostril, to a depth of approximately 1 cm, and rotated five times, for each healthcare worker. Both nostrils were sampled using the same swab and immediately sent to the microbiology laboratory for microbiological examination, culture, identification and antibiotic susceptibility testing.

Processing of sample: All the specimens were inoculated on mannitol salt agar (MSA) agar and on blood agar (BA) and incubated at 37°C for 48 hours. On MSA mannitol fermenting colonies were yellow or golden in colour and on blood agar (BA) colonies were greyish in colour. Colonies were then subjected to Gram staining, catalase test, coagulase test and urease test. The Gram positive, Catalase positive and Coagulase positive and Urease positive isolates were considered as *S. aureus*.

Antimicrobial susceptibility testing

All the isolated *Staphylococcus aureus* strains were tested against different antimicrobial agents by the Kirby Bauer disc diffusion method following Clinical Laboratory Standard Institute (CLSI) guideline 2015. The disc which were used are, cotrimoxazole (25µg), erythromycin (5µg), linezolid (30µg), penicillin (10units), and vancomycin (30µg), ampicillin (30µg) [Hi Media, Mumbai]. Finally, the data was recorded and analyzed at the completion of the study as per

recommendations of the CLSI guidelines 2015, *Staphylococcus aureus* ATCC 29213 was used as reference strain for the standardization of antibiotic susceptibility testing.

Detection of Methicillin Resistance *S. aureus*

MRSA was detected by Cefoxitin disc diffusion method-All strains were tested with 30µg cefoxitin discs (Hi-Media) on Muller – Hinton agar plates (MHA).For each strain, a bacterial suspension adjusted to 0.5 McFarland was used. The Zone of inhibition was determined after 16-18 hour incubation at 35°C.Zone size was interpreted to according to CLSI guideline (2015), if zone size was ≥ 22 mm consider as susceptible and if zone size was ≤ 21 mm consider as resistant. Oxacillin disc diffusion method- All strains were tested with 5µg oxacillin disc (Hi-Media) on Muller-Hinton agar plates. For each strain, a bacterial suspension adjusted to 0.5 McFarland Was used. The zone of inhibition was determined after 24 hour incubation at 35°C. Zone size was interpreted according to according to CLSI guideline (2015) if the zone size was ≥ 13 mm consider as susceptible, if zone size was 11-12mm considered as intermediate and if ≤ 10 mm considered as resistant.

Results and Discussion

In this present study, total 100 nasal swabs samples were taken from different health care workers including according to their occupation (attendants, sweepers, nursing staff, students, OT technicians). 20 nasal swab were taken from each group. Out of 100 samples, 60 were showing GPC in cluster in which 39 (39%) were Coagulase positive *Staphylococcus aureus* considered as *Staphylococcus aureus* and 21(21%) were Coagulase negative which were excluded, and in rest 40 isolates were gram positive cocci

along with gram positive bacilli. Out of 39 (39%) *S. aureus*, 15 (15%) were Methicillin Resistant *Staphylococcus aureus* (MRSA) and 24(24%) were Methicillin sensitive *Staphylococcus aureus* (MSSA).

According to their profession, most of the MRSA was isolated from sweepers followed by nurses, OT technicians, attendants and students.[Table 1] MRSA was mostly isolated from 26-30 age group.[Figure:1] Gender wise distribution according to their occupations is mentioned in figure 2. Antibiotic resistance pattern of isolated MRSA and MSSA is shown in fig 3. MRSA is now playing an important role in causing the infection in the hospitalized patients as well as in the community at large and the main sources of spread of infection in the hospital setup are the health care workers and the patients colonized with MRSA mainly in nose. If proper hand hygiene and other infection control measures are not adopted then these infections can spread very fast among the patients and this could increase their duration of stay in the hospitals and high financial burden. Therefore routine screening methods have to be followed for detecting the colonization of MRSA in the health care workers and also the patients.

In the present study 39.0% health care workers were found to be carrier of *S. aureus* in their anterior nares. The *S. aureus* carriage was highest among attendants (65%), followed by OT technicians (40%), sweepers (35%), students (30%) and staff nurses (25%). But there are many similar and contrasting studies from different institutions and epidemiological areas which showed lowest prevalence of *S. aureus* were by Himadri Mondal *et al.*, Mehrdad Askariana *et al.*, Sharon Rainy Rongpharpi *et al.*, and Vinodh Kumar Adityaa *et al.*, of 38%, 31%, 22% and 13% respectively. None of the health care workers were colonized with *S. aureus* as per Shoba *et al.*, (2005).

The present study provides an outlook on the prevalence of nasal carriage of MRSA among the health care workers in our hospital. Out of 100 health care workers screened, the prevalence of MRSA was 15.0% which was similar to the study of Bigasa *et al.*, (2008) but this result were in contrast to other studies which showed less prevalence rate, while Mehrdad Askariana *et al.*, Himadri Mondal *et al.*, reported showed highest prevalence of 17.2% and 18.39% respectively. Difference in the prevalence of nasal carriage of *S. aureus* strains may be due to differences in the quality and size of samples and the use of different techniques and different interpretation guidelines. In the present study according to different professions sweepers were major carrier of MRSA (71.4%;5 out of 7) followed by nurses (60%; 2 out of 5), OT

technician (37.5%; 3 out of 8), students (33.33%; 2 out of 6) and attendant (15.38%; 2 out of 13). Dechen Sering *et al.*, (2011) also found MRSA prevalence rate as carrier among sweepers (51.35%) followed by nurses and attendants of 25.58% and 25.53% respectively. Staff nurses are regularly in contact with patients and their prevalence rate vary from 4.54% to 25.5% (Lakshmi *et al.*, 2012). This could be because of lack of hand hygiene and awareness about infection control practices. In our study out of 51 males, 8 were positive (15.68%) and out of 49 females, 7 were positive (14.28%) this could be because of the reason that more number of male employees are working in our set up. Other findings also indicates high percentage of male were carrier of MRSA as compared to females (Ahmad, 2010; Shakya *et al.*, 2010).

Table.1 Distribution of different groups for *S. aureus*, MRSA and MSSA isolation

Groups	Total No.	No. of <i>S. aureus</i> Isolation rate [N (%)]	No. of MRSA isolated	No. of MSSA isolated
Attendants	20	13 (65%)	2	11
Sweepers	20	07 (35%)	5	2
Nurses	20	05 (25%)	3	2
Students	20	06 (30%)	2	4
OT Technicians	20	08 (40%)	3	5
Total	100	39 (39%)	15	24

Fig.1 Age wise distribution of MRSA positive isolates

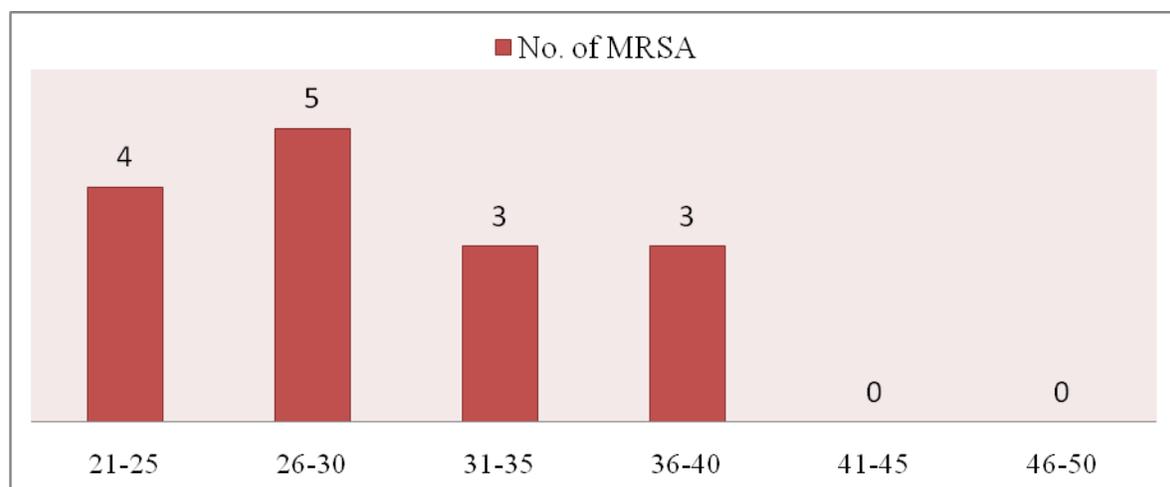


Fig.2 Sex wise distribution of MRSA Isolates among different groups

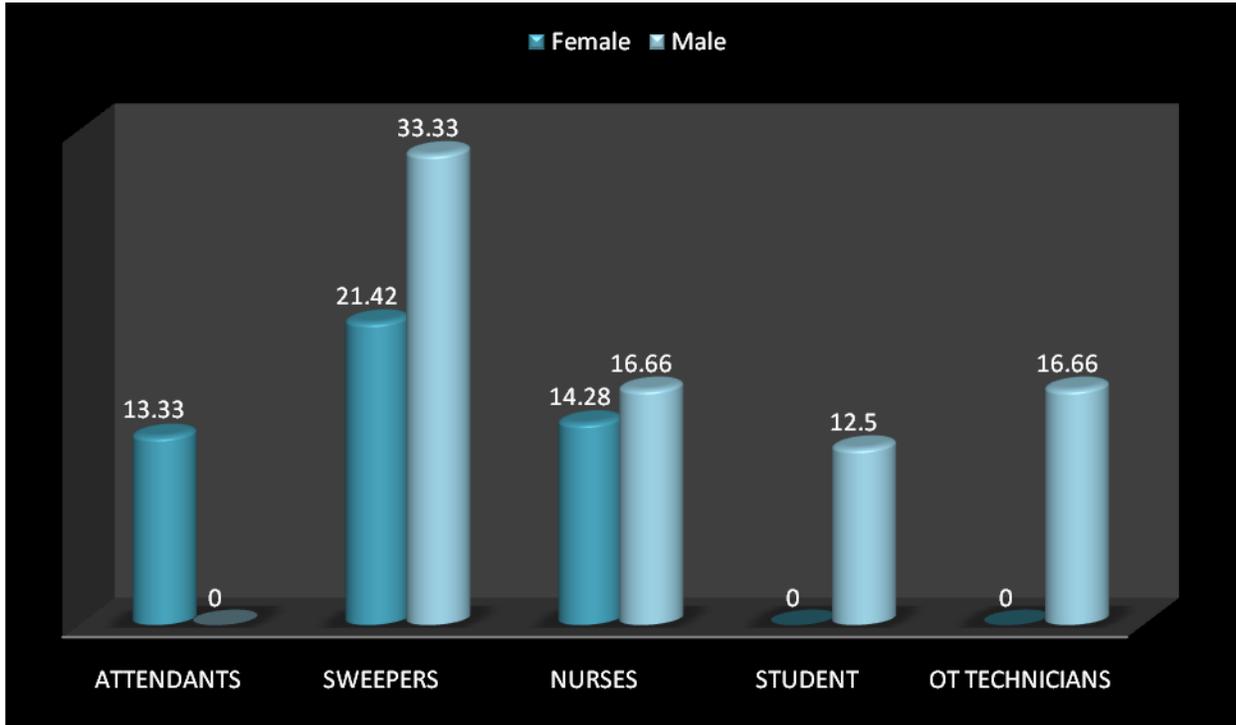
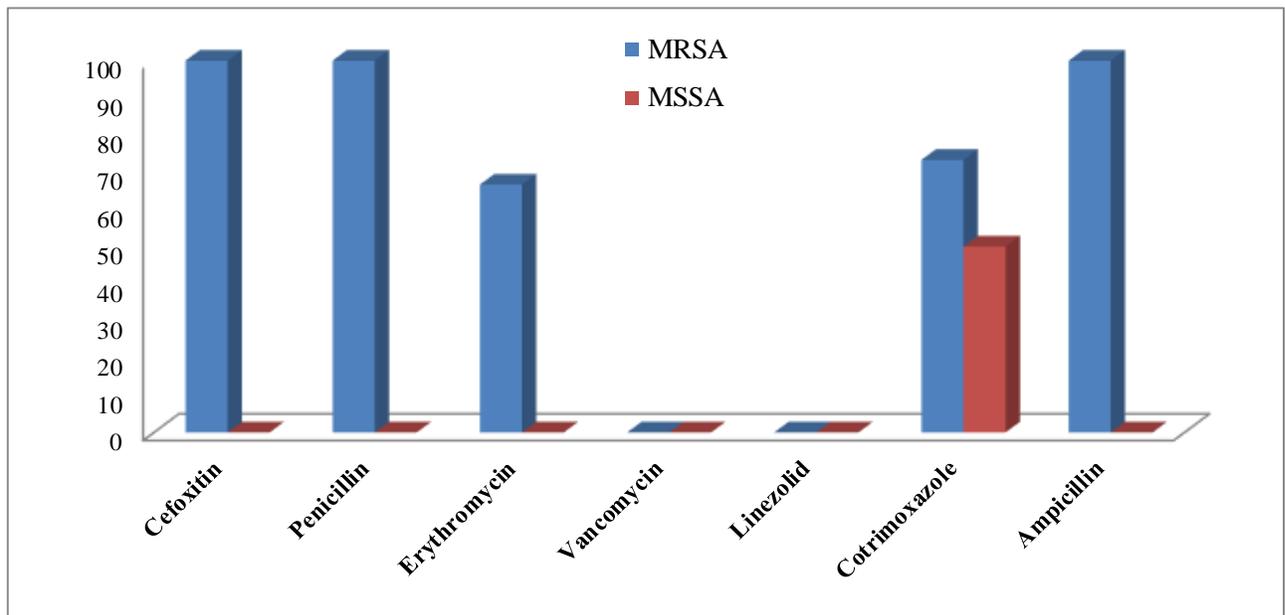


Fig.3 Antibiotic resistance pattern of *S. aureus*



The most common age groups affected in our study was between 36-40 years of age which showed a prevalence of (30.0%). It was slightly higher than Kausalya *et al.*, (2015)

who showed prevalence of (22.7%). In our study Vancomycin and Linezolid were found to be the most sensitive drugs against *S. aureus*. All 15 isolates of *S. aureus* were

100% resistant to Cefoxitin in the present study but another study conducted by Vinodh kumaradityaa *et al.*, and Sharaon Rainy Rongpharpi *et al.*, showed lower percentage of (15.4%) and 11.43% *et al.*, respectively. Penicillin was found to be 100% resistant to all strains of *S. aureus*, similar finding was showed by Bala *et al.*, (2010) and also by Goyel *et al.*, (2016) but Sharaon Rainy Rongpharpi *et al.*, and Kausala *et al.*, reported 90% and 71.4% *S.aureus* were resistant to penicillin. Erythromycin was found to be (66.66%) resistant in our study, similar finding was observed in Bala *et al.*, (2010) with (66.66%) resistance, but slightly higher percentage was shown by Kausalya *et al.*, (2015) (67.9%) resistant. In our study Ampicillin was found 100% resistant which was higher than study conducted by Neerja Jindal *et al.*, (2016) showing (82.0%) resistance, and also (88.57%) resistance by Sharaon Rainy Rongpharpi *et al.*, (2013). Cotrimoxazole was found (73.33%) resistant in the present study, slightly lower percentage was found in Neerja Jindal *et al.*, (2016) (57.1%), Vinodh kumar adityaa *et al.*, showed (46.1%) resistance, Sharaon Rainy Rongpharpi *et al.*, (2013) have shown prevalence of (31.43%) resistance.

In conclusion, this study indicates towards creating awareness among sweepers, nurses, OT technicians, students and attendants. Health care workers, who acquire MRSA, can transmit these multidrug resistant strains to their family members, who eventually spread such strains into the community. In our study we identified the carriers of MRSA and treated them with mupirocin ointment for 3 times in a day for 5 days and also excluded them from their work for 48 hours from the start of mupirocin ointment. Simple preventive measures like hand washing, using sterile mask and gown and avoiding touching one's nose during work, should be reinforced in all health care settings. This study reiterates

the need for periodic surveillance, early and accurate detection and treatment of MRSA carriers. This should be accompanied with appropriate hospital infection control measures, to prevent the nasal carriage of MRSA in hospital health care workers.

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